

PROGRESS REPORT
on
PLANNING RESEARCH IN THE AREA OF
LAUNCH VEHICLE AND PROPULSION PROGRAMS
Contract Number NASw-1146
For March, 1968

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

REPORT NUMBER BMI-NLVP-TPR-68-2

by

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April 12, 1968

INTRODUCTION

This is the second progress report on NASA Contract Number NASw-1146 for 1968. The report covers the period from March 1 to March 31, 1968. As in previous reports, the following sections cover:

- General Discussion
- Specific Activities
- Plans for Future Activities
- Time and Cost Estimates.

GENERAL DISCUSSION

During March, 1968, principal activities involved:

- (1) Program review at NASA Headquarters on March 21, 1968 (All WTDs).
- (2) Continuing support of the Prospectus exercise and program at GSFC (WTD 17 and 22).
- (3) Continued work on the Orbital Launch Operations study (WTD 20).
- (4) Making the POP Mechanization program operational at BMI and initial collection of data (WTD 22).
- (5) Submission of the initial report on spacecraft propulsion (WTD 12).
- (6) Submission of the report on "broken plane" transfers to Mercury (WTD 10).
- (7) Submission of a report on direct out-of-ecliptic missions (WTD 19).
- (8) Mailing of the updated Atlas/Centaur section in the LV Performance Document and continued work on the Delta material (WTD 5).
- (9) Work on modifying the Mission Document Generator (WTD 4).
- (10) Reassembling the LVPP brochure in accordance with an SV request (WTD 14).
- (11) Preparation of a list of data on OSSA orbiting items expected to reenter during the 1968-1971 time period for analyses by OMSF on the NRL computer program (WTD 3).

- (12) Preparation of data to ease the problem of estimating Earth orbital operations requirements (WTD 21).
- (13) Submission of data on HOSS (Delta) performance from French Guiana (WTD 12).
- (14) Preparation of slide material for the LV presentation at the AIAA meeting at San Francisco on April 10, 1968 (WTD 14).
- (15) Submitted report on coplanar circular orbit transfers (WTD 10).

Permission to publish the Multi-Payload and Starlet reports in still awaited.

SPECIFIC ACTIVITIES

Comments are given for currently supported activities only.

A. Task Definition (WTD 2) -

No activity.

B. Exploratory Studies (WTD 3) -

Data was mailed to Lt. Col. Schulherr (IL-68-105) on OSSA upper stages and spacecraft which can be expected to reenter the Earth's atmosphere in the 1968-71 time period. These were normalized to equivalent Agenas (Gemini) so that they could be analyzed by OMSF using the computer program at NRL. A more detailed report is being prepared for consideration in OSSA and SV, in particular. This report cannot be finalized until the results of the OMSF analysis at NRL is completed.

C. Mission Document (WTD 4) -

The revision of the Mission Document generator program continues. Decisions concerning content will have to be made in the near future.

D. Performance Document (WTD 5) -

The updated Atlas/Centaur section of the Performance Document has been submitted to SV for distribution. The Delta data will require considerable manipulation to put it in the required format. There appears to be some discrepancies in the data. Scout, Agena, Titan, and Saturn data have not yet been received.

E. Project Support (WTD 6) -

Normal activity except for preparation of material for the program review at Code SV on March 21, 1968. There were several attendees at this review from OART and Bellcom.

F. Economic Analysis (WTD 8) -

Activity under this WTD was restricted to providing data, reviewing some recent data, and making a few modifications in the EDD.

G. Applied Mathematics (WTD 10) -

- (1) IM-68-6 was submitted on "Transfers Between Coplanar Circular Orbits Using Fixed Amounts of Fuel".
- (2) IM-68-7 was submitted on "Broken Plane Transfers to Mercury".

H. Propulsion Studies (WTD 12) -

- (1) LR-68-1 on spacecraft propulsion policy was submitted and has been used by SV in discussions with Code SL.

- (2) Work is in process on a more comprehensive spacecraft propulsion report to assemble relevant data under a single cover.
- (3) Permission to publish the Starlet report has still not been received from Code SV.

I. Prospectus Follow-on (WTD 14) -

- (1) The LVPP brochure was reassembled in accordance with SV instructions. A draft copy was submitted for approval and signature by Dr. Naugle or J. Mahon.
- (2) Slides were prepared for the McGolrick/Davis presentation to the AIAA on April 10, 1968, at San Francisco.

J. Technical Area Plans (WTD 15) -

Nominal activity.

K. Guidance and Electronics (WTD 16) -

No activity.

L. Prospectus Support (WTD 17) -

Assistance to SV and other OSSA offices was being provided as requested. A review of all project data sheets will be made following the Senior Council meeting at GSFC during April, 1968.

M. Estimating Factors Book (WTD 19) -

Holes are being filled and modifications made in Sections II and III in preparation for the next issue (i.e., for Prospectus 1968).

N. Multi-Payload Study (WTD 20) -

- (1) The Multi-Payload report was still being reviewed in Code SV.
- (2) Work on Orbital Lunar Operations continues.

O. LV Mission Studies (WTD 21) -

- (1) Earth orbital data permitting more flexibility in determination of mission requirements was in final preparation. Some of this data will be included in the next Estimating Factors Book.
- (2) Data on out-of-ecliptic missions using Jupiter gravity assist was being developed. This will undoubtedly be used in the next EFB.

P. Prospectus Mechanization (WTD 22) -

(1) Prospectus Mechanization

- (a) The program is being used at GSFC. Some problems have been encountered. Although some of these problems have been caused by the complexity of input forms and failure to fill these out properly, most of the difficulty has apparently been the result of computer and computer system malfunctions on the IBM 360-91 at GSFC.
- (b) Some changes will be made to the program at GSFC following the Senior Council meeting.

(2) POP Mechanization -

- (a) The program is ready for production at BMI.
- (b) Data submissions have been received from Code SPR and are being processed.
- (c) It appears that the 68-1 POP material will be complete by mid-April, 1968.
- (d) There are plans for transferring the program to GSFC and providing support during the 68-2 POP exercise. Code SV and SPR have yet to indicate how this will be funded.

Q. Project Development Plans (WTD 23) -

No activity.

PLANS FOR FUTURE ACTIVITIES

During the near future, it is planned to:

- (1) Publish the Starlet report (WTD 12).
- (2) Publish the Multi-Payload report (WTD 20).
- (3) Process POP 68-1 data at BMI prior to publication by Code SPR (WTD 22).
- (4) Continue the OLO study (WTD 20).
- (5) Publish a limited distribution report on hazards from space program debris (WTD 3).
- (6) Support SV on the Prospectus Exercise (WTD 17).
- (7) Complete work on the Mission Document generator program and prepare the new Mission Document for publication (WTD 4).
- (8) Continue updating the LV Performance Document (WTD 5).
- (9) Publish various items of data on Earth orbital and other missions (WTD 22).
- (10) Publish a more comprehensive report on spacecraft propulsion (WTD 12).
- (11) Begin assembling material for the next EFB (WTD 19).
- (12) Start work on "Project Development Plans" when possible (WTD 23).

TIME AND COST ESTIMATES

Below are estimates of time and costs on Contract Number NASw-1146, on each WTD, for March, 1968, and through March, 1968.

	<u>March, 1968</u>		<u>February-March, 1968</u>	
	<u>Man-Hours</u>	<u>Costs</u>	<u>Man-Hours</u>	<u>Costs</u>
(2) Task Definition	None	\$ None	10	\$ 225
(3) Exploratory Studies	105	1,740	200	3,365
(4) Mission Document	35	1,300	35	1,300
(5) Performance Document	50	620	65	945
(6) Project Support	140	2,180	425	5,105
(8) Economics	20	375	95	1,150
(10) Mathematics	50	710	60	1,235
(12) Propulsion Studies	280	5,700	620	12,900
(14) Prospectus Follow-On	90	1,280	140	2,380
(15) Technology Planning	None	None	None	None
(16) Guidance	None	None	None	None
(17) Prospectus Support	None	None	None	None
(19) EFB Support	95	2,425	335	8,250
(20) Multi-Payload	235	3,115	455	6,440
(21) Mission Analysis	110	2,175	135	2,750
(22) Prospectus Mechanization	435	13,565	1,155	33,740
(23) Development Plans	<u>None</u>	<u>None</u>	<u>None</u>	<u>None</u>
	1,645	\$35,185	3,730	\$79,785

Figure 1, on the following page, shows the relationship of the actual rate of expenditures on this project and the budgeted rate.

